

Gravity and Solar System

Talk to a Teacher

<http://spoken-tutorial.org>

National Mission on Education through ICT

<http://sakshat.ac.in>

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Learning Objectives



Learning Objectives

- ▶ Demonstrate **Gravity and Orbits** and **My Solar System**, PhET simulations



System Requirement



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- ▶ **Ubuntu Linux OS v 14.04**



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- ▶ **Java v 1.7.0**



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- ▶ **Ubuntu Linux OS v 14.04**
- ▶ **Java v 1.7.0**
- ▶ **Firefox Web Browser v 53.02.2**



Pre-requisites



Pre-requisites

- ▶ **Learner should be familiar with topics in high school science**



Learning Goals



Learning Goals

- ▶ Describe the relation between Sun, Earth, Moon and Satellite



Learning Goals

- ▶ Describe the relation between Sun, Earth, Moon and Satellite
- ▶ Study the effect of mass and distance on gravitational force



Learning Goals

- ▶ Describe the relation between Sun, Earth, Moon and Satellite
- ▶ Study the effect of mass and distance on gravitational force
- ▶ Explain how gravity controls the motion of our solar system



Learning Goals



Learning Goals

- ▶ **Identify the variables that affect the strength of gravity**



Learning Goals

- ▶ Identify the variables that affect the strength of gravity
- ▶ Determine the gravitational force



Solar System



Solar System

- ▶ In our solar system, all the celestial objects revolve around the Sun



Solar System

- ▶ In our solar system, all the celestial objects revolve around the Sun
- ▶ These objects are planets, moons, comets, asteroids, meteors and meteorites



Gravitational Force



Gravitational Force

- ▶ **There exists a force of attraction between the Sun and the celestial objects**



Gravitational Force

- ▶ There exists a force of attraction between the Sun and the celestial objects
- ▶ This force of attraction is gravitational force



PhET Simulation-Link



PhET Simulation-Link

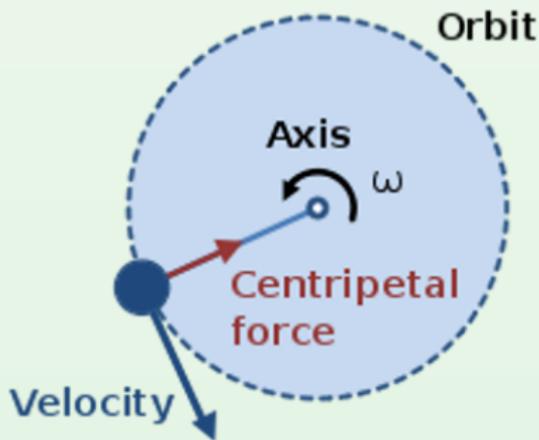
<https://phet.colorado.edu>



Centripetal Force



Centripetal Force



- ▶ **Centripetal force causes change in acceleration and keeps the body moving along the circular path**



Assignment



Assignment

Using **Model** screen,
Explore earth, moon and earth,
satellite systems



Universal Law of Gravitation



Universal Law of Gravitation

- ▶ The force of attraction between any two objects is proportional to the product of their masses



Universal Law of Gravitation

- ▶ The force of attraction between any two objects is proportional to the product of their masses
- ▶ It is inversely proportional to the square of the distance between them



Universal Law of Gravitation



Universal Law of Gravitation

- ▶ This force is along the line joining the centers of two objects



Calculation of Gravitational Force



Calculation of Gravitational Force

$$F = \frac{G \times M \times m}{d^2}$$

$$G = 6.67 \times 10^{-11} \text{ Nm}^2 / \text{kg}^2$$

$$M = 1.989 \times 10^{30} \text{ kg} \quad m = 5.972 \times 10^{24} \text{ kg}$$

$$d = 91503 \times 10^3 \text{ mile} \quad 1 \text{ mile} = 1.609 \times 10^3 \text{ m}$$

$$F = \frac{[(6.67 \times 10^{-11})(1.99 \times 10^{30})(5.97 \times 10^{24})]}{[(91503 \times 10^3 \times 1.609 \times 10^3)^2]}$$

$$F = \frac{79.27 \times 10^{43}}{2.165 \times 10^{22}} \quad F = 3.6 \times 10^{22} \text{ N}$$



Assignment



Assignment

Using **To Scale** screen,
Determine the gravitational force
between Earth and satellite



Assignment



Assignment

1. **Select various systems and observe the orbits**
2. **Change the Initial settings and observe the changes in the orbits**
3. **Explain the observation**



Summary



Summary

- ▶ **How to use Gravity and Orbits and My Solar System, PhET simulations**



Summary



Summary

- ▶ Described the relation between Sun, Earth, Moon and Satellite
- ▶ Studied the effect of mass and distance on gravitational force
- ▶ Explained how gravity controls the motion of our solar system



Summary



Summary

- ▶ **Identified the variables that affect the strength of gravity**
- ▶ **Determined the gravitational force**



About the Spoken Tutorial Project

- ▶ Watch the video available at http://spoken-tutorial.org/What_is_a_Spoken_Tutorial
- ▶ It summarises the Spoken Tutorial project



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- ▶ If you do not have good bandwidth, you can download and watch it



Spoken Tutorial Workshops

The Spoken Tutorial Project Team

- ▶ Conducts workshops using spoken tutorials
- ▶ Gives certificates to those who pass an online test
- ▶ For more details, please write to contact@spoken-tutorial.org



Forum for specific questions

- ▶ Do you have questions in **THIS Spoken Tutorial?**
- ▶ Please visit
<http://forums.spoken-tutorial.org>
- ▶ Choose the minute and second where you have the question
- ▶ Explain your question briefly
- ▶ Someone from our team will answer them



Acknowledgements

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Acknowledgements

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- ▶ **It is supported by the National Mission on Education through ICT, MHRD, Government of India**
- ▶ **More information on this Mission is available at**

<http://spoken-tutorial.org/NMEICT-Intro>

